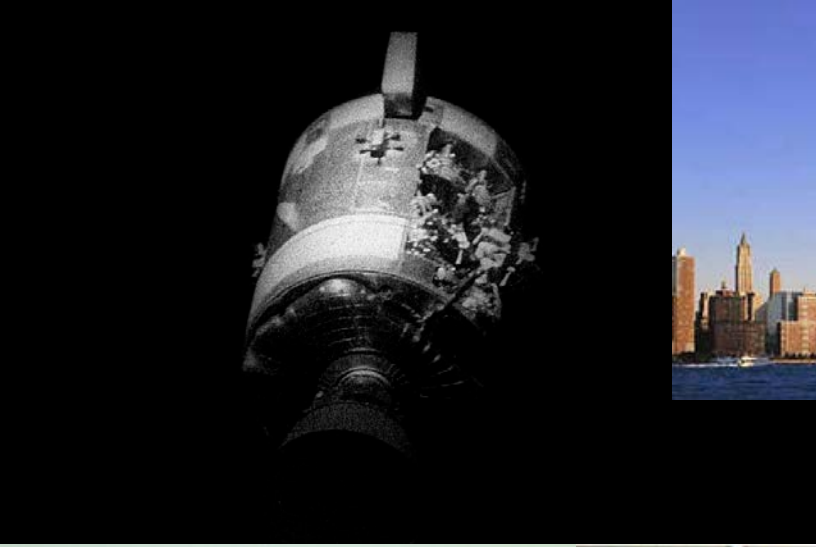
ME 1110 – Engineering Practice 1

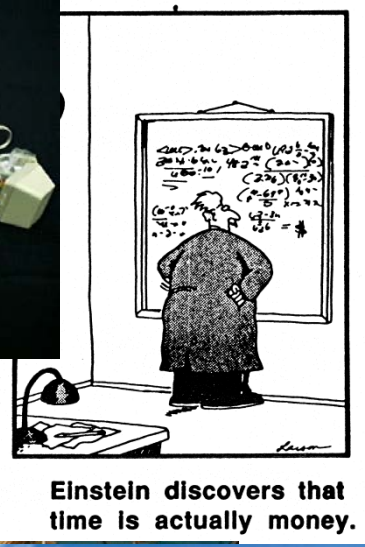
Engineering Drawing and Design - Lecture 1

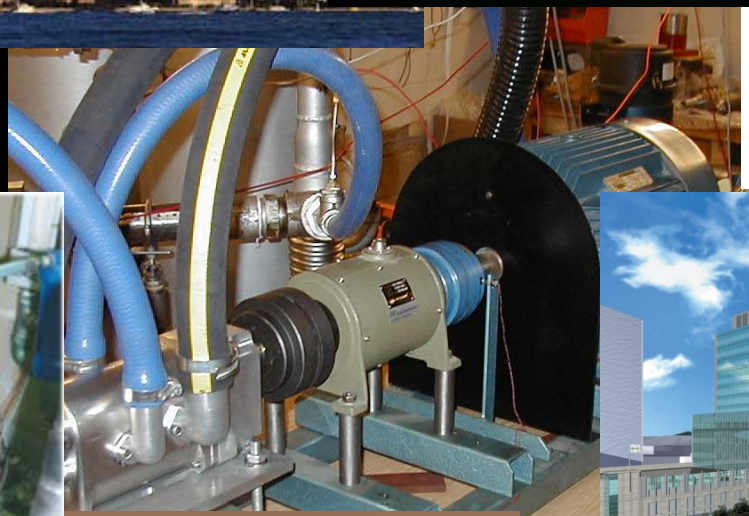
Introduction

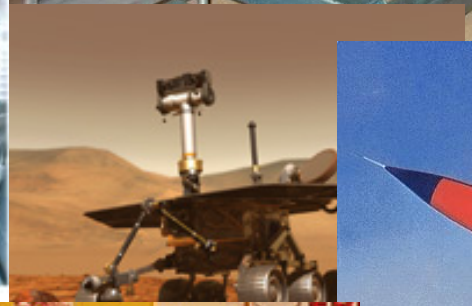
Prof Ahmed Kovacevic

School of Engineering and Mathematical Sciences
Room CG25, Phone: 8780, E-Mail: **a.kovacevic@city.ac.uk**
www.staff.city.ac.uk/~ra600/intro.htm




Einstein discovers that
time is actually money.






RL 205

Definition of Design

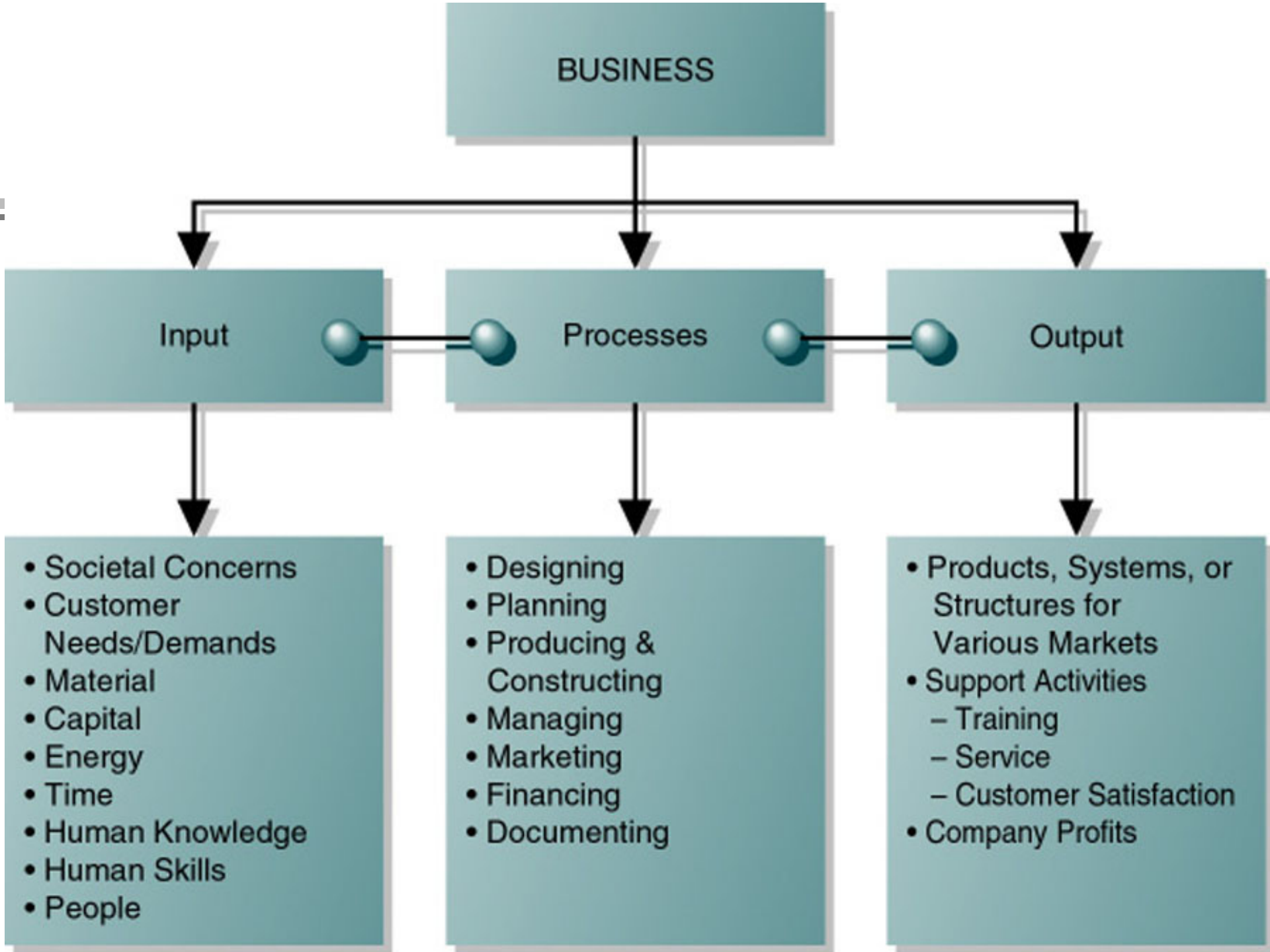
Design is ***process*** of ***conceiving or inventing*** ideas mentally and ***communicating*** these ideas to others in a form that is easily understood.

Design is a ***systematic*** action by which solution to the ***needs*** of humankind are ***obtained and communicated***.

Design is essence of ***Engineering***.

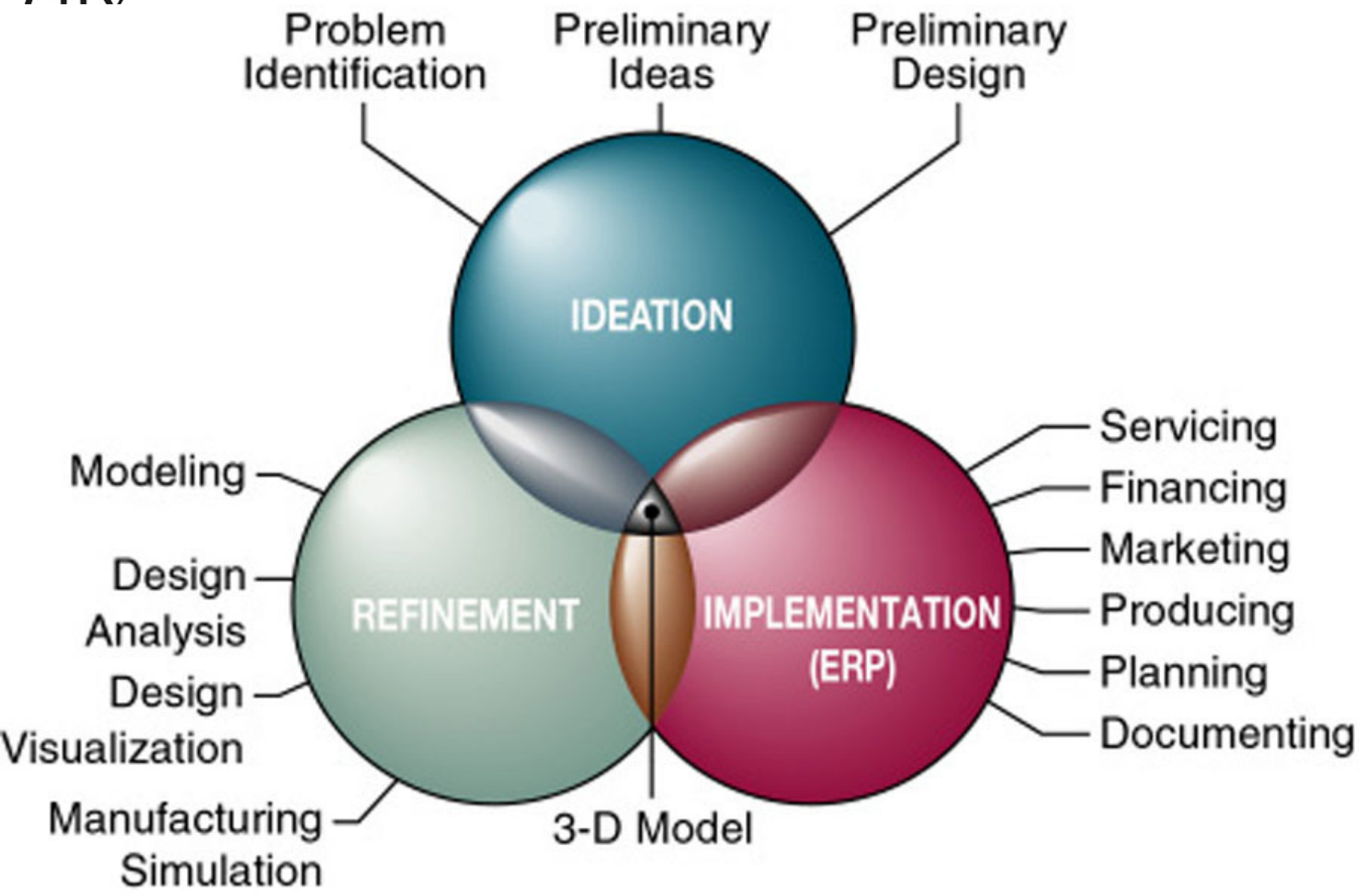
Designing is a ***multidisciplinary*** task influenced by *technological* and *social* factors.

Designing is ***iterative***, ***team work*** and continually learning process.


BUSINESS
Input
Processes
Output
• Societal Concerns
• Customer Needs/Demands
• Material
• Capital
• Energy
• Time
• Human Knowledge
• Human Skills
• People
• Designing
• Planning
• Producing & Constructing
• Managing
• Marketing
• Financing
• Documenting
• Products, Systems, or Structures for Various Markets
• Support Activities
– Training
– Service
– Customer Satisfaction
• Company Profits

Phases of Engineering Design

Design web



The Nature of Design

People have always *DESIGNED* artefacts*!
(Everything which is not a simple untouched peace of Nature has been designed)

In craft-based societies concepts of ‘designing’ and ‘manufacturing’ are not separate.
(Example is a potter who makes a pot directly from his head)

In modern societies these processes must be separate. Making process cannot normally start before the artefact has been designed
(In electronics, design can take months and manufacturing only seconds)

Design has to provide a clear description of the artefact that has to be made.
(Almost nothing should be left to the discretion of those who manufacture the artefact)

Despite the method used to design an artefact, the essential design activity is *to produce its ‘description’*.

***Artefacts are artificial objects, products, processes, etc.**

Communication of Design

Design has to be delivered in a form *understandable* to those who make or approve an artefact .

The most widely used form of communication is *DRAWING*.

Drawings need to convey information in the most precise manner – must be made in accordance to a certain rules and principles.

Learning to read and make drawings is a very important part of design education!

Philosophy of Designing in general

- Governing everything could be seen in one overriding principle of ‘Necessity’
  - » Principle of ‘Necessity’ dictates that the form always perfectly fits function in nature, with no insufficiency or redundancy; it compels every force to expand itself in the most direct way available for it; it prescribes that the simplest design to achieve a given end will be followed; and it must be respected by any human contriver of artificial things.
- ‘Necessity’ is the mistress and teacher of nature; necessity is the theme and inventor of nature, the curb, the rule and the theme.’
- The universal architecture of Necessity is geometry

From Martin Kemp’s book “Leonardo”

35 years of Apple history

Apple, one of the pioneers on the personal computer market, has retained its technological and designer edge to this day

1976

Steve Jobs and **Steve Wozniak** registered **Apple**

The original logo from 1976

Apple I – one of the first PCs

1977

Apple II – the first popularly used PC

1984

Macintosh – the first PC with a graphic interface (instead of a command line interface)

1985

Steve Jobs leaves the company

1991

Powerbook – the notebook (laptop) that has become the model for other PCs of its kind

1993

Apple Newton – the first PDA (Personal Digital Assistant – a pocket PC)

1997 Steve Jobs returns to the company

1998

iMac – a series of monoblock PCs that were appreciated, among other things, for their advanced design

2001

iPod – a media player that took absolute command of the market due to its convenient features and simple design

2007

iPhone – a smart phone with revolutionary multi-touch technology that instantly became a top seller on the market

2010

iPad – tablet PC with multi-touch technology that became a sensation in 2010

Apple's profits (in millions of dollars)

335 1,516 1,918 6,310 7,977 7,081 5,941 5,363 24,578 65,225

1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

14% Other
8% iPad
12% iPod
27% Mac
39% iPhone

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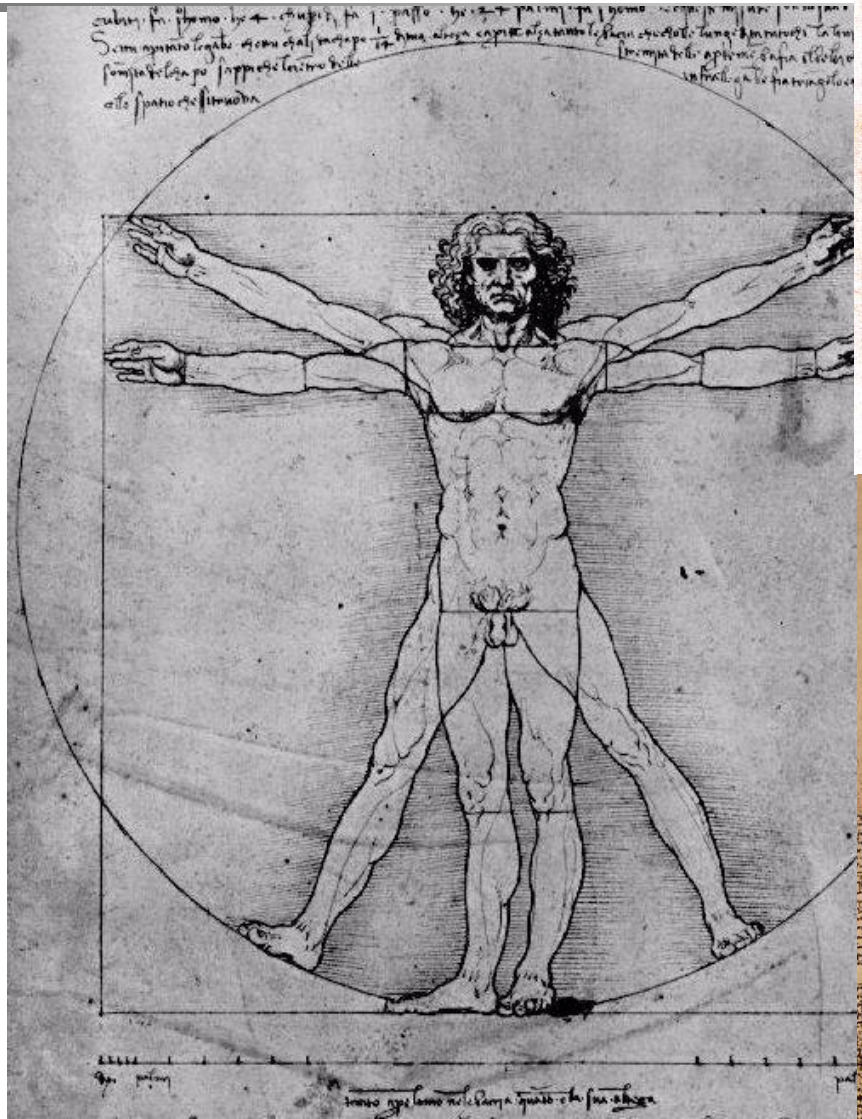
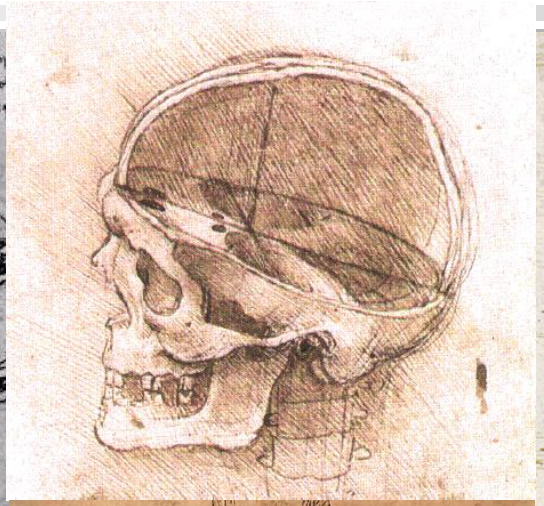
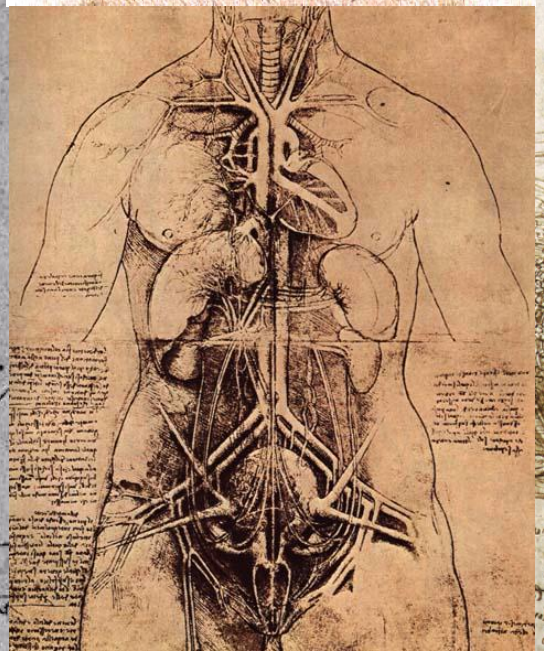
All designs start with understanding a problem

Dryden Flight Research Center EC95-42883-4 Photographed 1995
SR-71B over snow-capped mountains. NASA photo

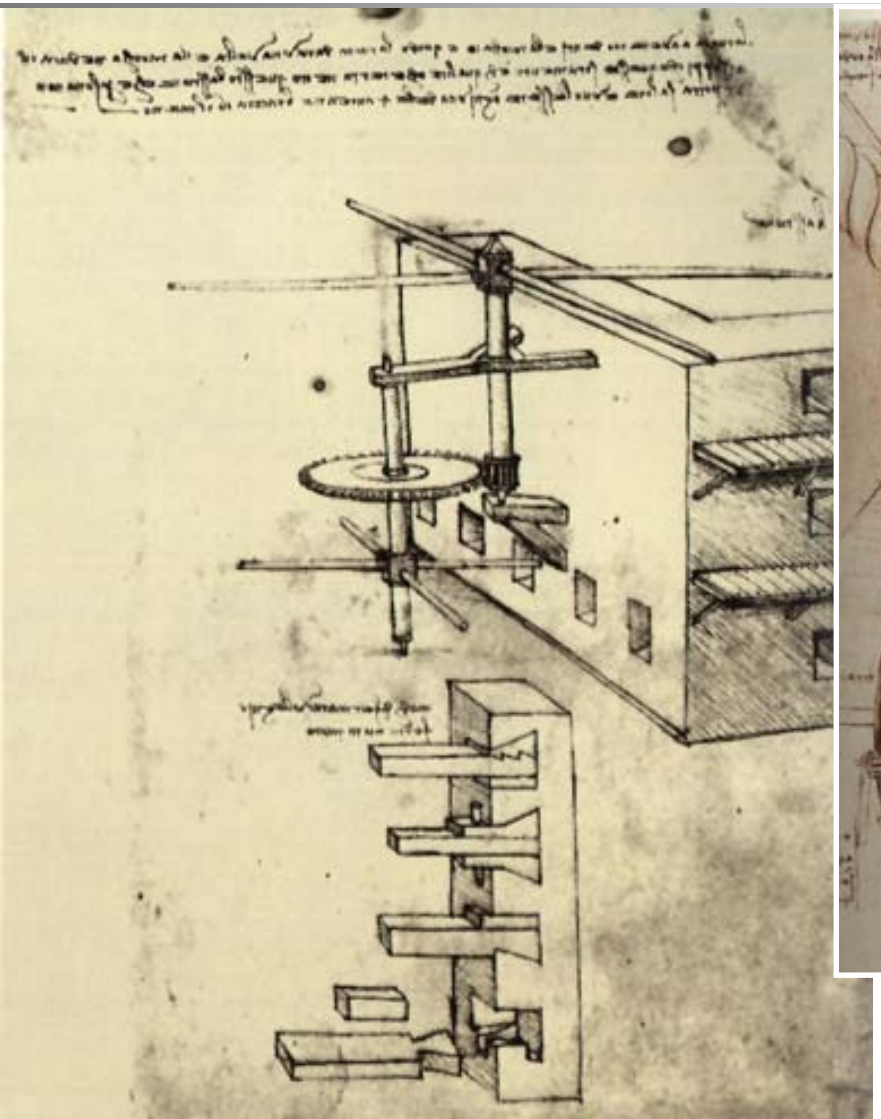
Understanding the Nature

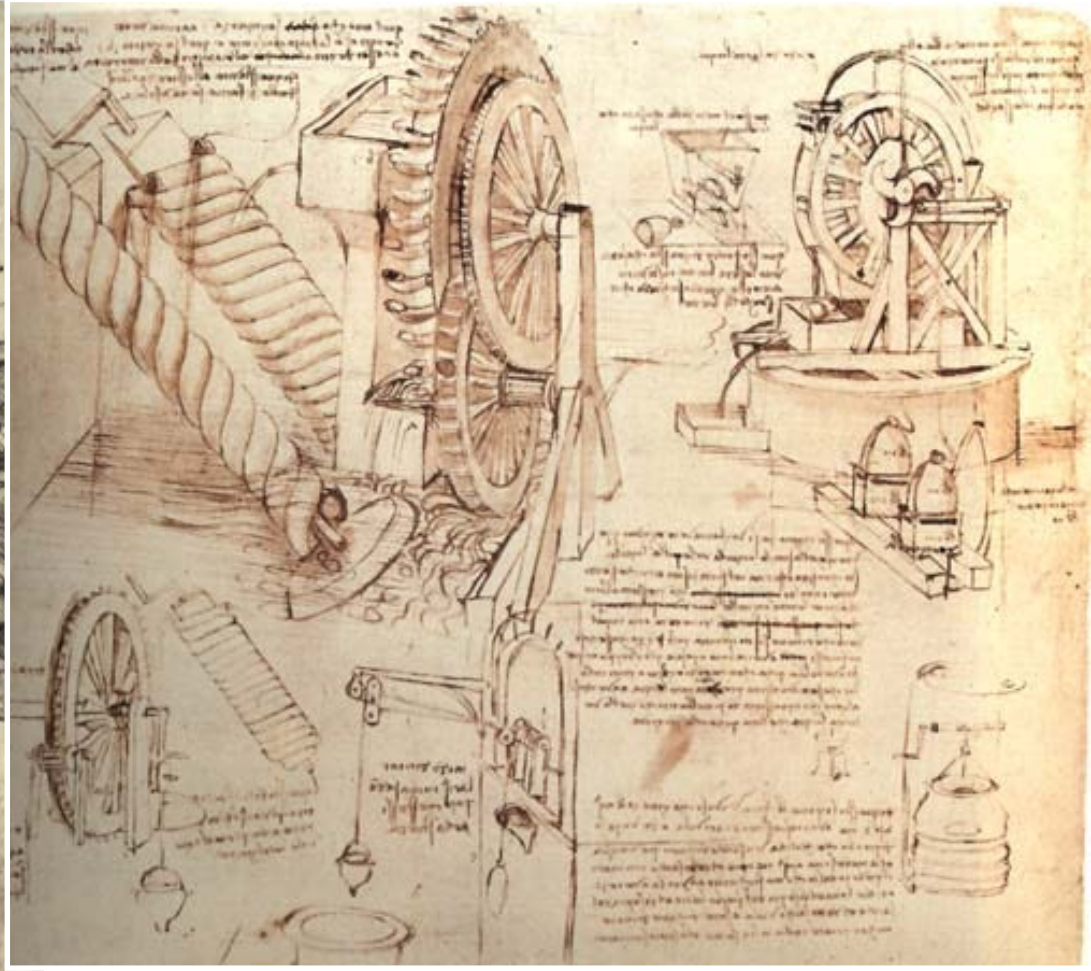






Generation of ideas





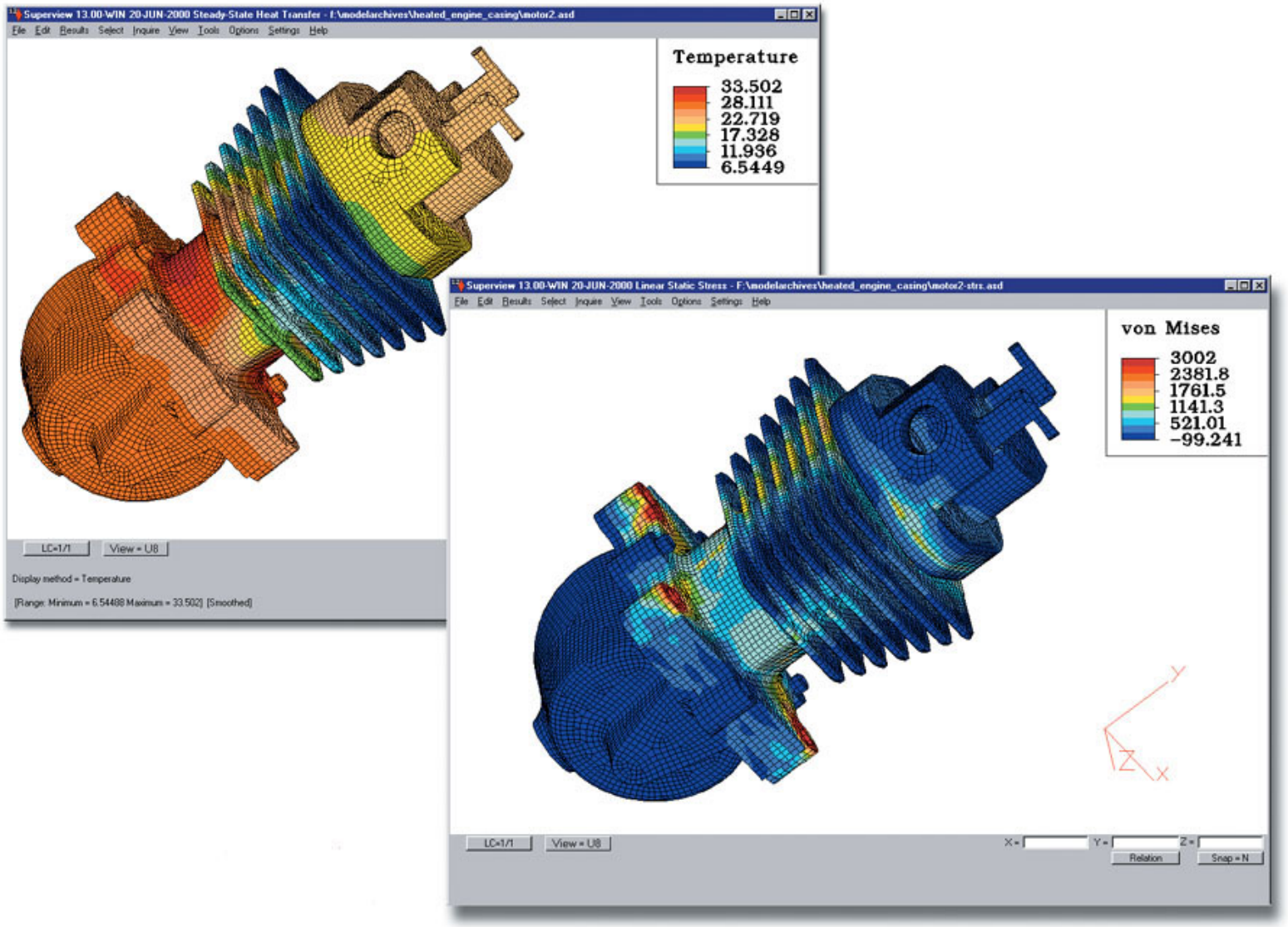
Real model created with a rapid prototyping system

Source: Courtesy of 3D Systems, Inc.

Virtual reality technology

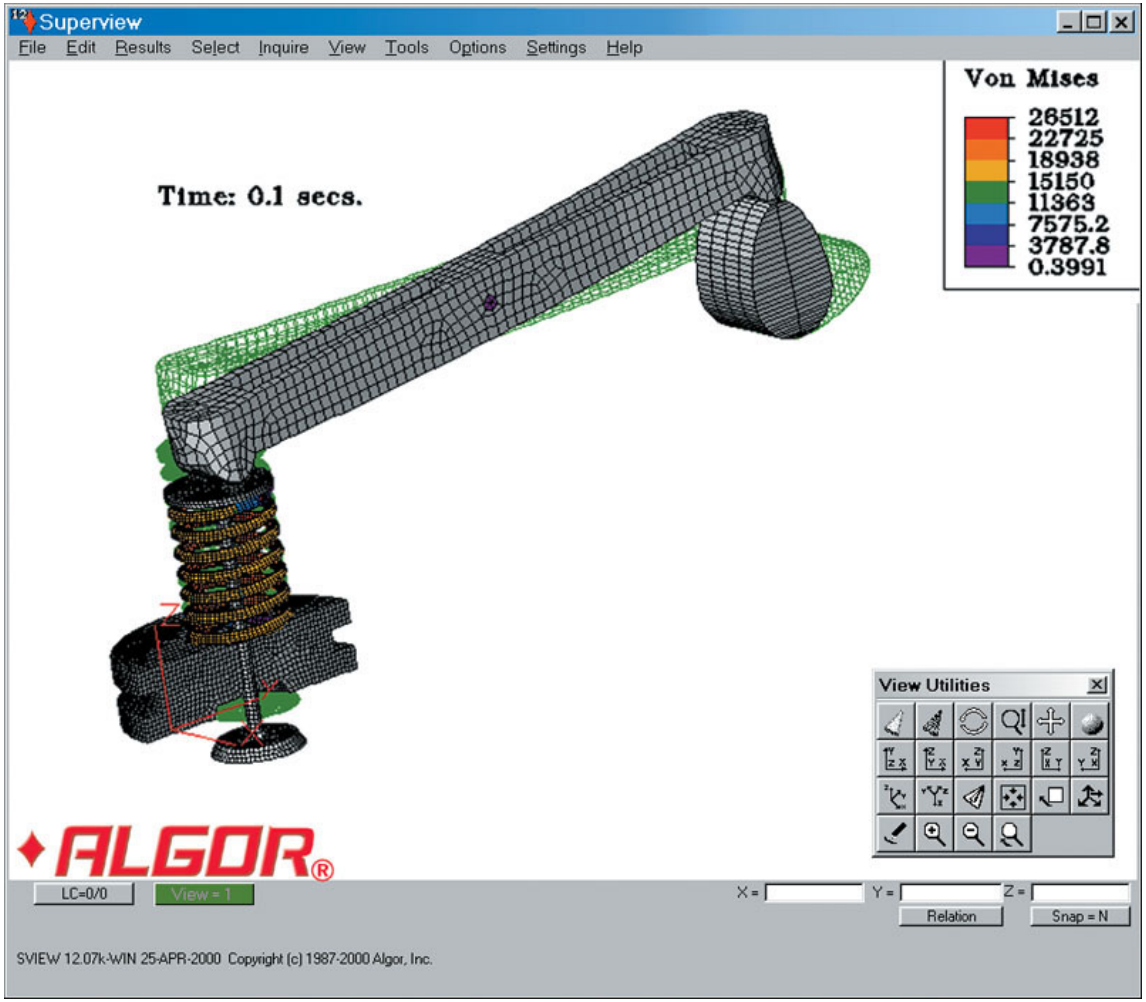
Source: Courtesy of Fakespace Systems, Inc.

Thermal analysis



Source: Photo courtesy of Algor, Inc.

Stress analysis

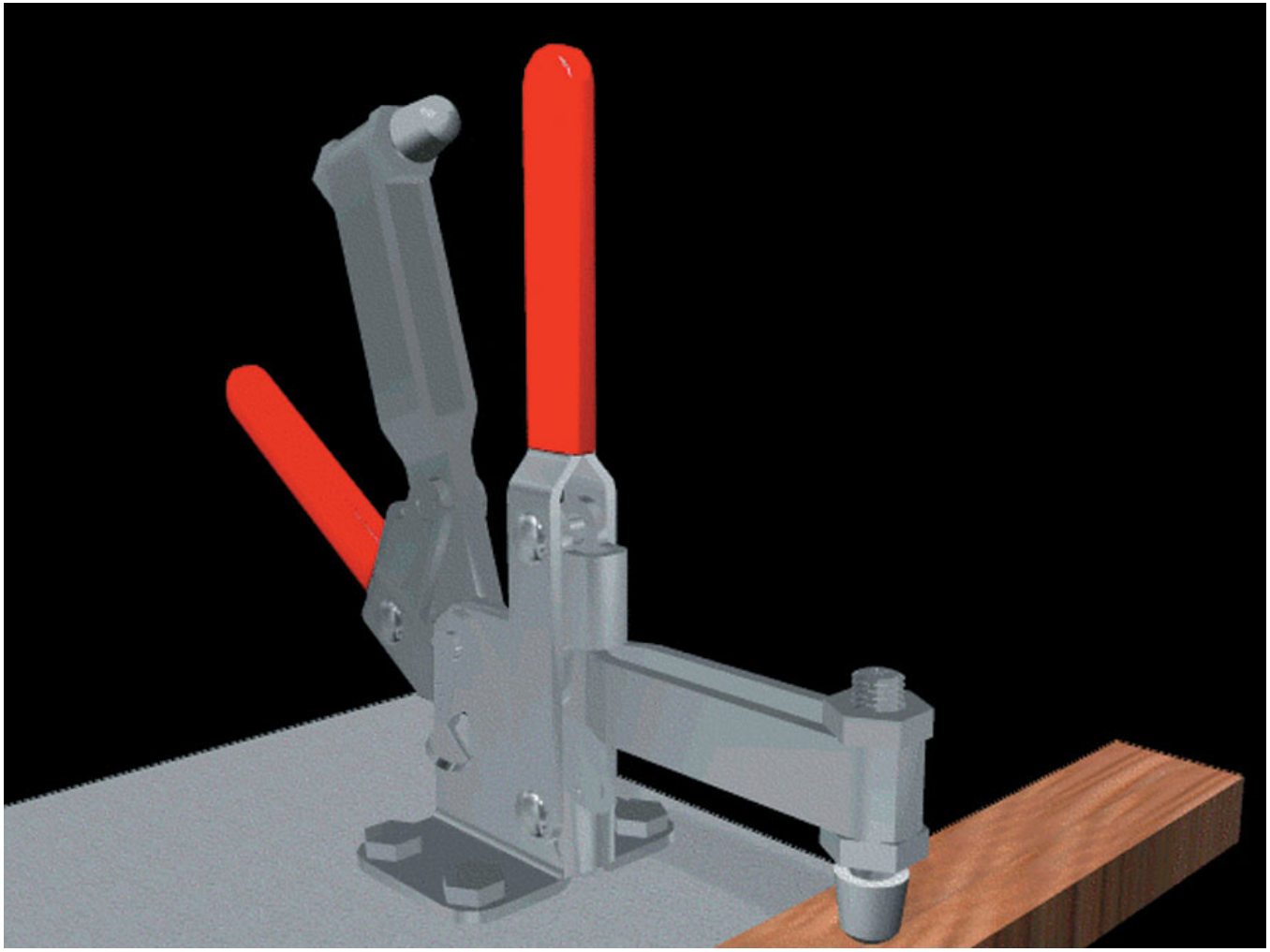


Source: Photo courtesy of Algor, Inc.

Assembly analysis

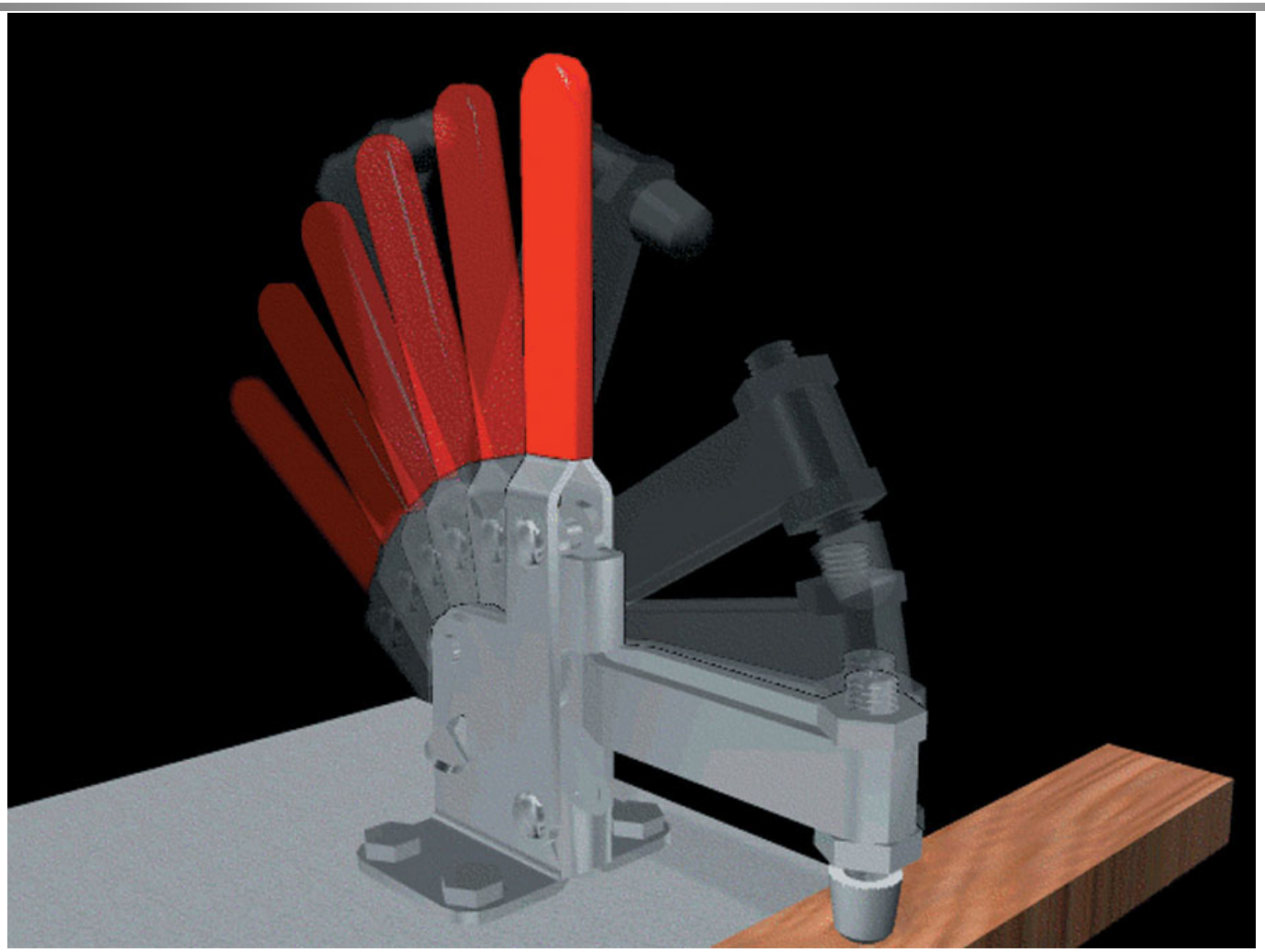
Source: Courtesy of Gary Bertoline.

Kinematic analysis



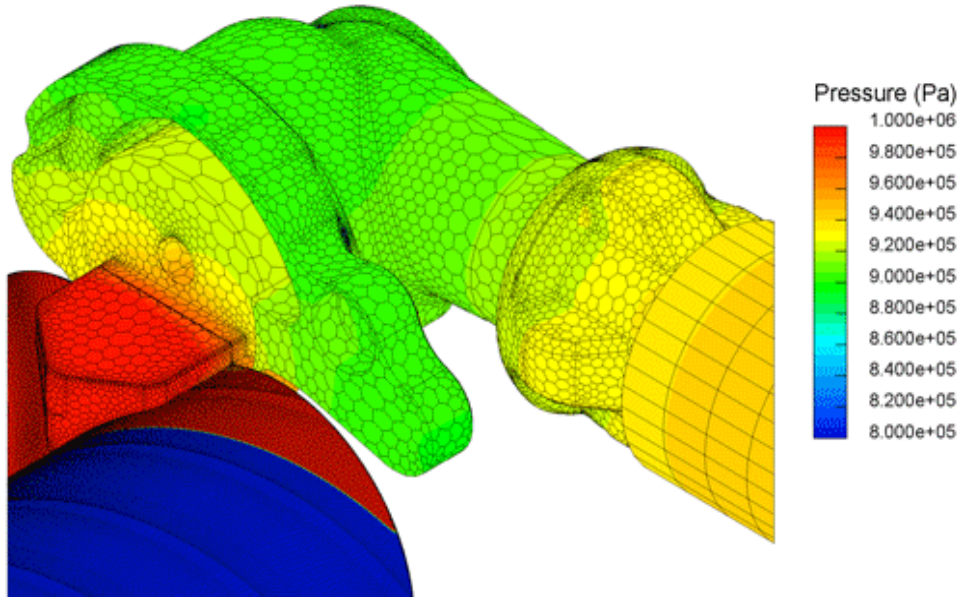
Source: Courtesy of Gary Bertoline.

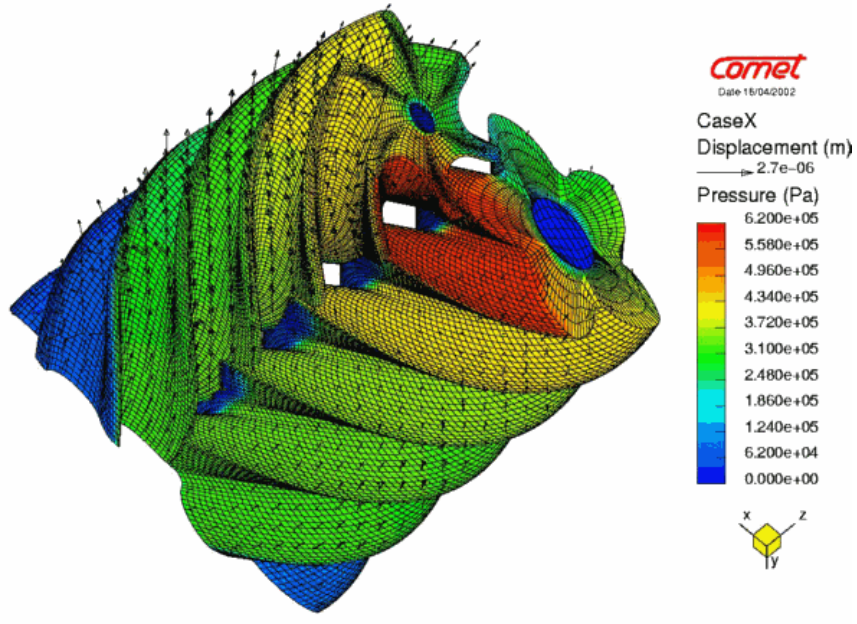
Dynamic analysis



Source: Courtesy of Gary Bertoline.

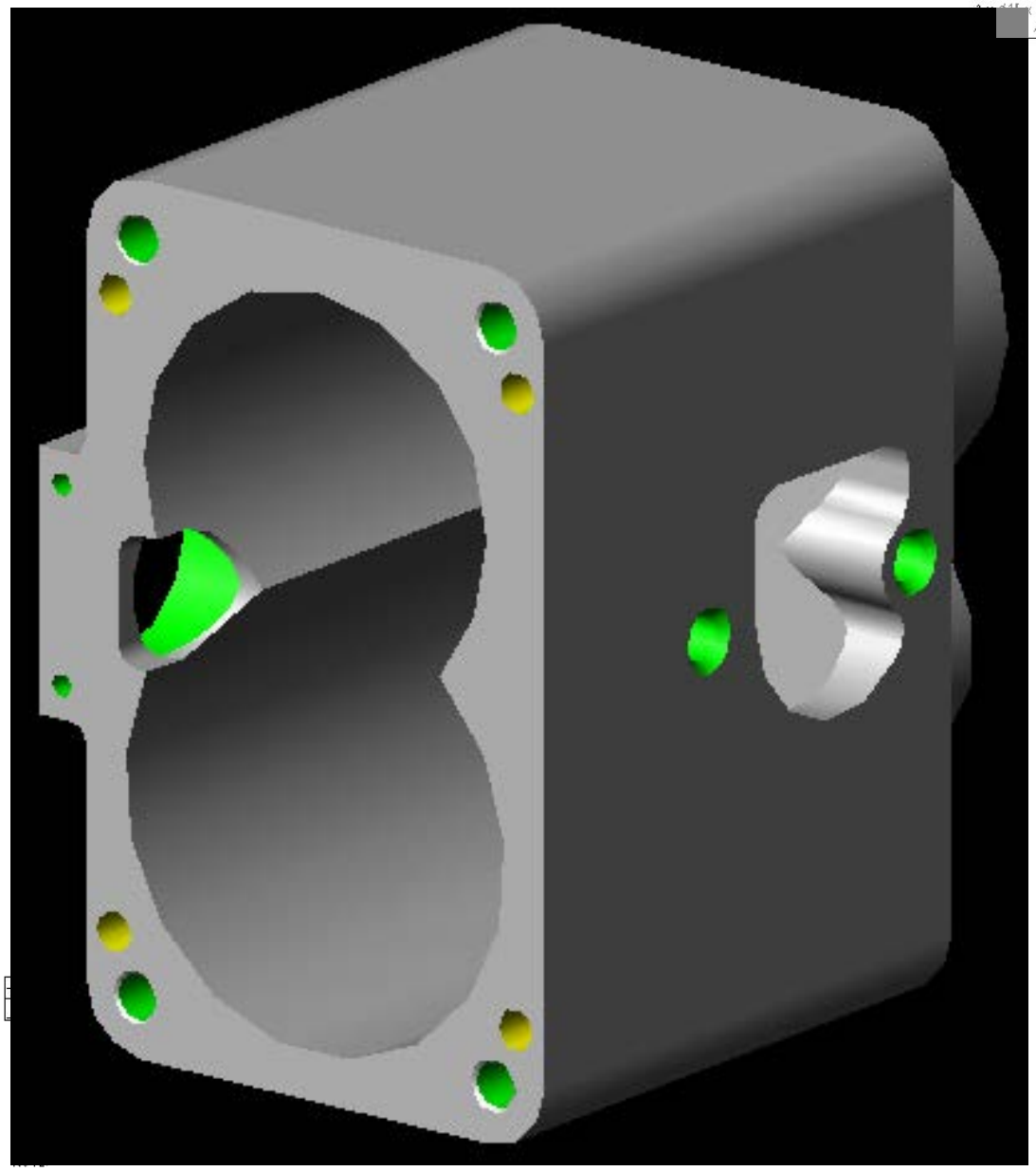
Fluid dynamics and Fluid solid interaction analysis

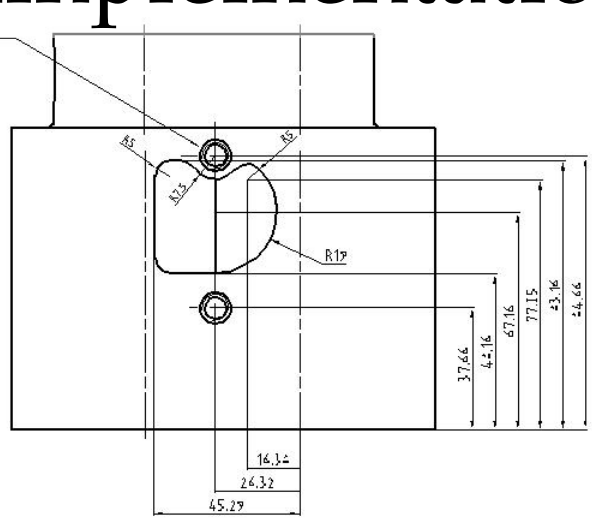


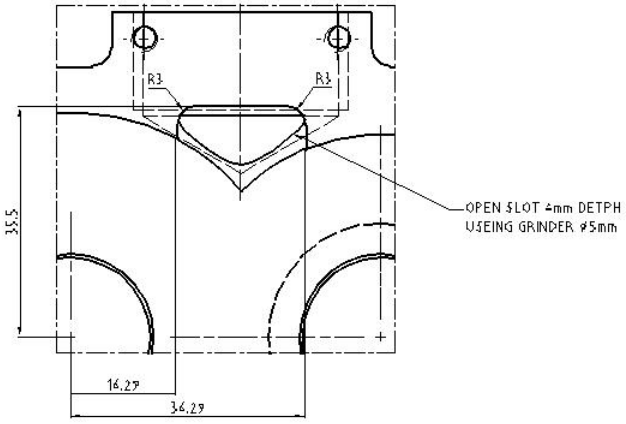


Source: Courtesy of Gary Bertoline.

Implementation







DETAIL A (2:1)

1. All unspecified radii to be 5 mm
2. All unspecified chamfers to be 1.5/45°

Item	Qty	Standard	Material	Note
4	1		Cast Iron	

MODEL	LFC-000-v4	CITY University — CENTRE FOR POSITIVE DISPLACEMENT COMPRESSOR TECHNOLOGY
MATERIAL		

	NAME	DATE
DESIGNED	EM	07/09/04
DRAWN	EM	07/09/04
CAD	EM	14/02/05
CHECKED	AK	
APPROVED	NS	07/09/04

Bearing Housing
Compressor – Expander (M)
city_a2

REF.DRG No. | FILE NAME

SCALE 1:1 | Drawing No. LFC-004-v4 | DRG.SHEET 1 | REVISION

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ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE THIS DRAWING IF IN DOUBT ASK DESIGN CENTRE

Abstract design

Source: © Matthew Kaplan: Photri.

Aesthetic design

Source: © Michael Rosenfeld: Stone.

Functional design

Source: © Michael Rosenfeld: Stone.

Aesthetic and functional design

Objectives of the course

- Develop ability to design and communicate
- Use of scientific principles in design
- Use of design tools (CAD, CAE etc)
- Work in **engineering design teams**
- Make design process creative

Engineering Drawing and Design

- Course Outline :
  - » Basic concepts of engineering drawing
  - » Introduction to Computer Aided Design – AutoCAD
  - » Introduction to Engineering Design
  - » Introduction to Mechanical Design
  - » Series of exercise through CV to learn above…

Engineering Drawing and Design

Term 1

Lectures : Mondays $17^{00} – 17^{50}$

Venue : A103

Course leader and Lectures: Prof Ahmed Kovacevic

CAD lectures: Ms Mary Aylmer

Tutorial leader: Dr Sham Rane

Term 2

Lectures : Thursdays $17^{00} – 17^{50}$

Venue : Poynton

Course leader and Lectures: Prof Ahmed Kovacevic

Tutorial leader: Dr Sham Rane

Tutorials

Course leader:

Prof Ahmed Kovacevic

(CG25)

Tutorial leader:

Dr Sham Rane

(CD41)

Tutors:

Miss Israt Kabir

Miss Bhagya Chagarlamudi

Mr Milad Mirshani

(CG41)

Tutorial Part1 ME1110 - Engineering Drawing and Design

Group	Term 1	Tutor
A	Tuesdays CLG54; 09^{00}-11^{00}	Miss Israt Kabir
B	Mondays CLG54; 11^{00}-13^{00}	Mr M. Mirshahi
C	Tuesdays CLG54;15^{00}-17^{00}	Miss Bhagya C
D	Thursday CLG54; 09^{00}-11^{00}	Mr M. Mirshahi
EME	Thursday CLG54; 15^{00}-17^{00}	Miss Bhagya C

How are you assessed?

Coursework only, **No Final Year Exam**

- 5 Drawing and 3 CAD exercises (2 in-class)
- 2 design exercises
- 2 group projects
- 2 in-class tests (one in each term)

Marks obtained from coursework tutorial classes and in-class tests are added together to calculate the final grade.

Pass mark – 40% overall

Syllabus, Marking Scheme, Deadlines

Textbooks

- Technical Drawing with Engineering Graphics, 14/e,
  Giesecke, Mitchell, Spencer, Hill, Dygdon, Nocak and Lockhart
- Engineering Design Graphics, Leak and Borderson
- Manual of Engineering Drawing: To British and International Standards Simmons and Maguire
- Practical Engineering Drawing, B. Hadley ISBN 0 582 36983 5
- Fundamentals of Graphical Communication, 3/e,
  G.R.Bertoline, E.N.Wiebe, C.L. Miller, McGrawHill
- Engineering Design and Problem Solving,
  Eide, Jenison, Mashaw, Northup, McGrawHill
- Engineering Design Methods
  Nigel Cross, John Willey & Sons, LTD, ISBN 0-471-87250-4

What you need to have and what to do ?

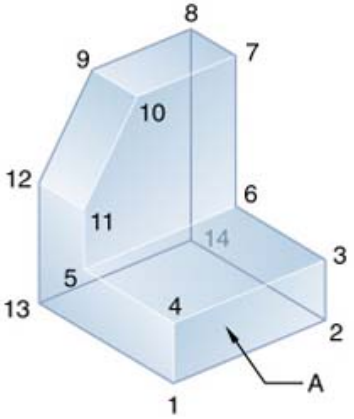
- Course material: Moodle and Course web page:
  http://www.staff.city.ac.uk/~ra600/intro.htm
- Drawing equipment:
  - 2 pencils (one soft and one hard), rubber eraser
  - set of rulers and a compass
  - A3 paper
- Essential for good results:
  - Attendance to both lectures and tutorials
  - Patience and time invested in learning
  - Each week 1-2 hours of out of class work
- Submit coursework directly to MEA General Office.
- Late submission penalty applies:
  - 20% for 1 Week late
  - 60% for 2 Weeks late
  - 100% for > 2 Weeks late

NOTE ?

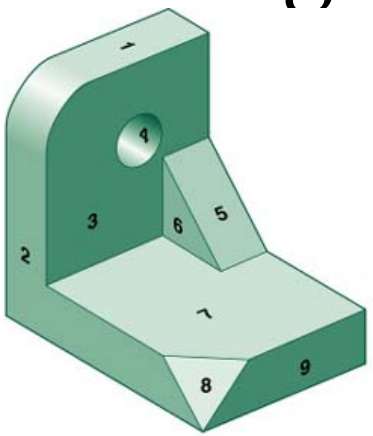
» Student must attend all Tutorial classes.
Attendance is recorded and used in Examiners board

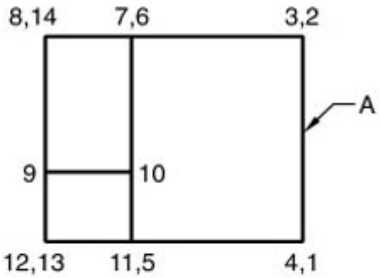
» No student will be allowed in the class without necessary DRAWING INSTRUMENTS and INSTRUCTION SHEETS

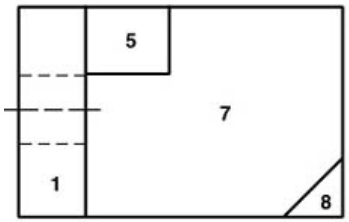
Line and Surface labelling

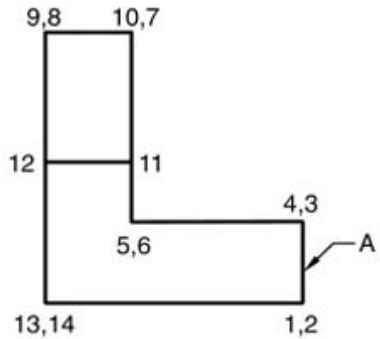


Top view

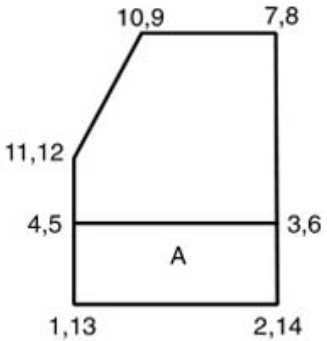




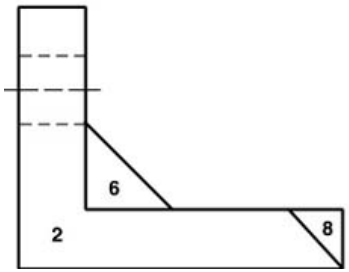


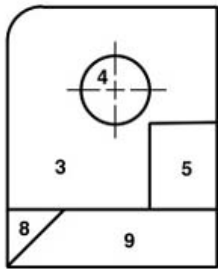


Front view



Right side





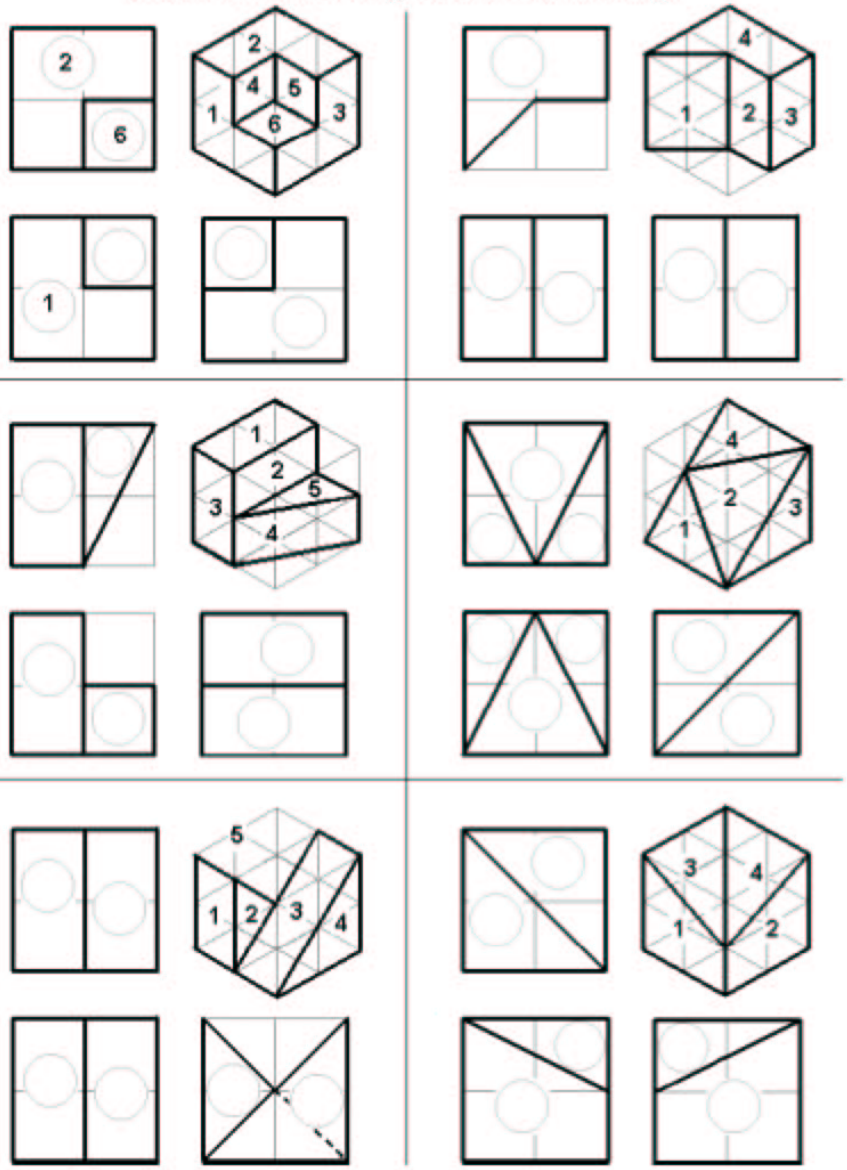
Ahmed Kovacevic, City University London

Design web

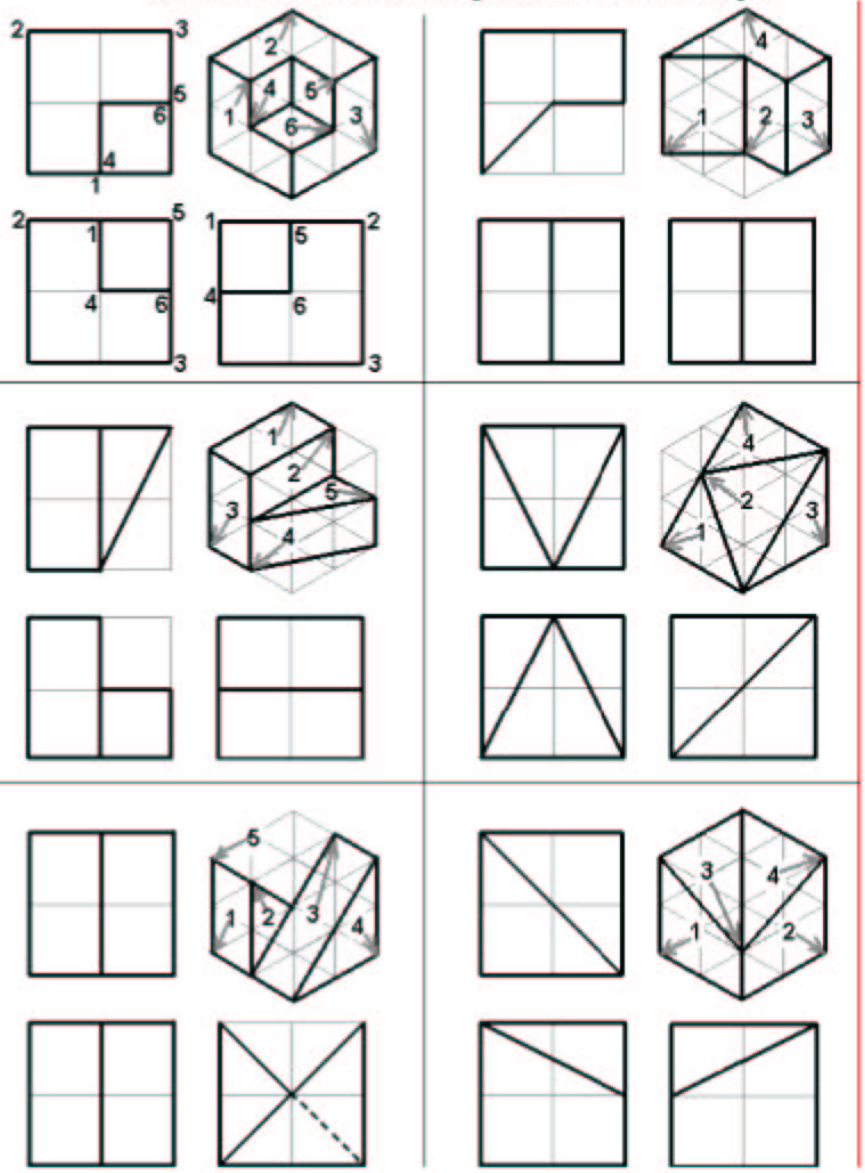
Exercise DrE-1a

STUDENT NAME:

DrE-1: Part I Number the faces labelled in the pictorial drawing in every view of themultiview drawings as shown in the example



DrE-1: Part II Number the endpoints labelled in the pictorial drawing in every view of the multiview drawings as shown in the example

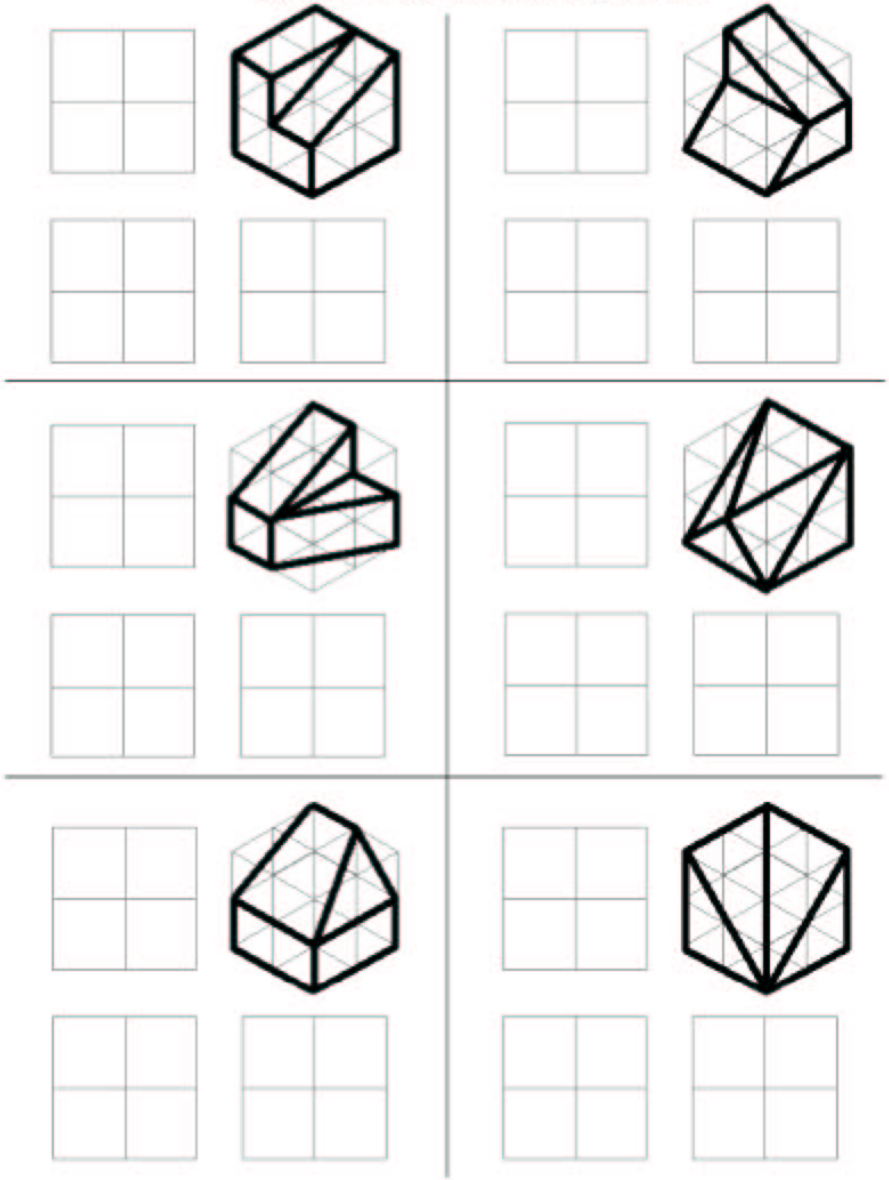


Exercise DrE-1a

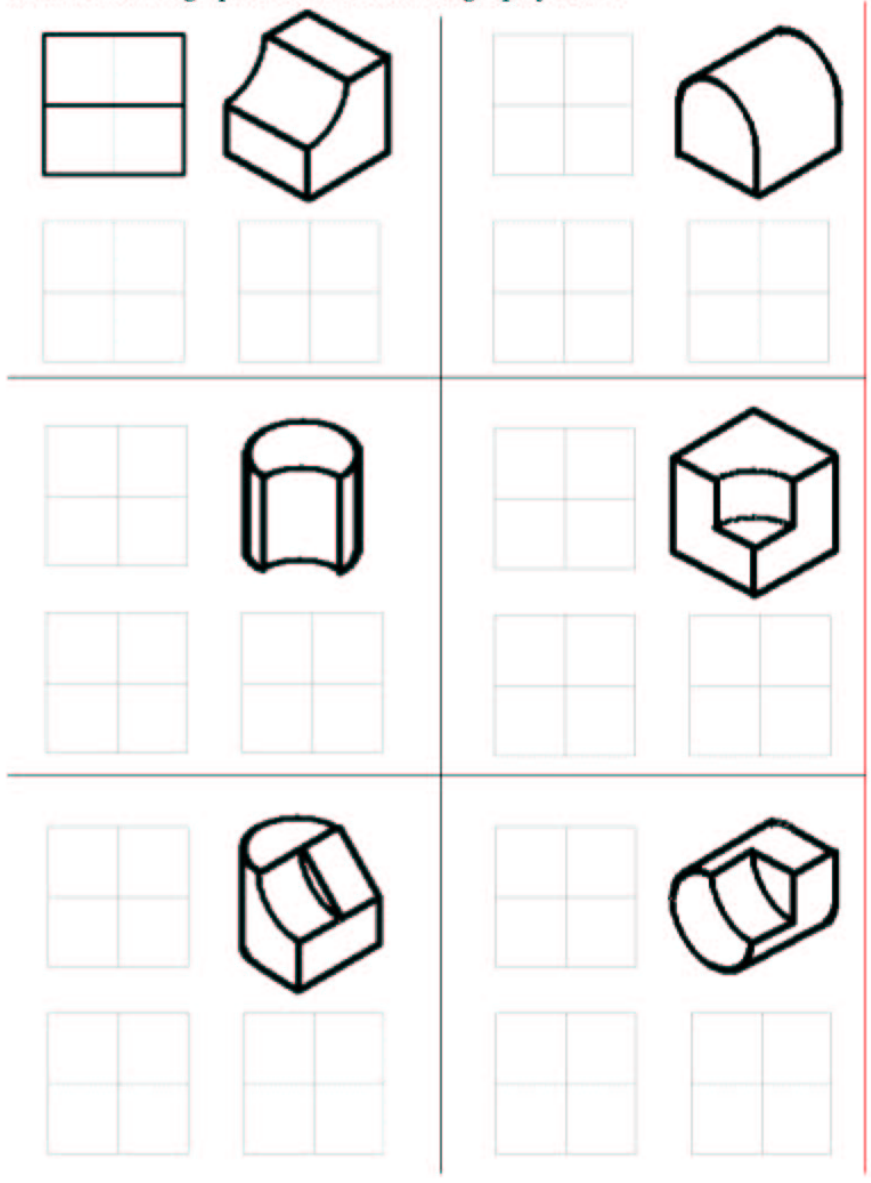
Design web

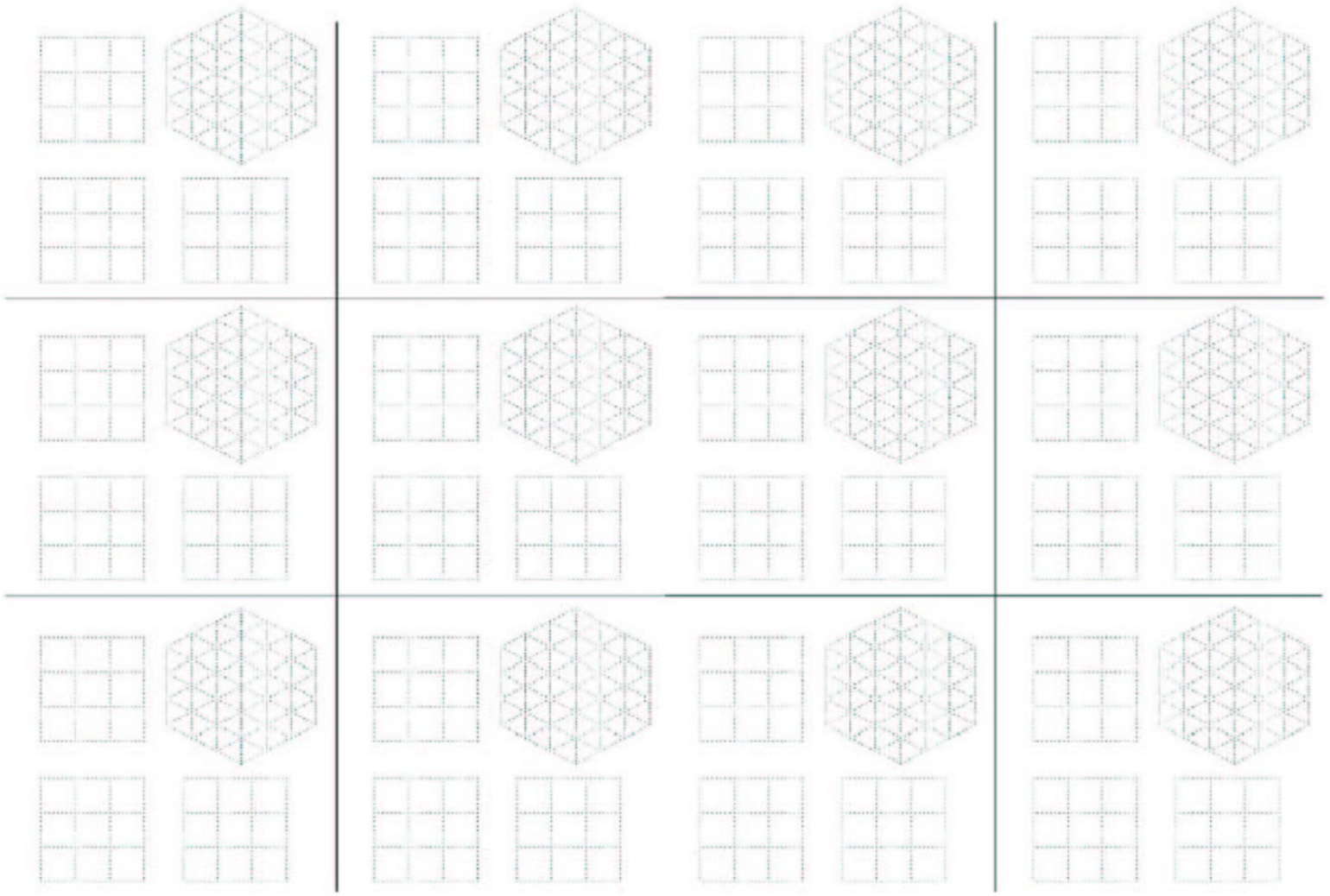
DrE-1: Part III

Complete the multiview drawing in 3rd angle projection for each of six pictorial drawings shawn



Part IV: After completing this sheet use template on attached A3 page, draw the border and title block, fill in the block and transfer both pictorial sketches and multiview orthographic sketches in 3rd angle projection.





Group and Tutor Name	Exercise Code and Title	Page No		SCALE DATE	NAME